THE
AMERICAN JOURNAL
OF THE MEDICAL SCIENCES.

DECEMBER, 1906.

SPECIAL ARTICLE.

INFANTILE MORTALITY AND ITS PRINCIPAL CAUSE —DIRTY MILK.

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I. INFANTILE MORTALITY RATES.

Although it is generally well known that the mortality among infants and young children is very high, it is not commonly recognized that much of it is due to causes which are avoidable, and to one in particular which can be effectively controlled by individual and concerted effort. In this country, the annual waste of infant life fails to attract the attention to which it is entitled, largely because of indifference and ignorance on the part of the public and of public authorities to the importance of registration of vital statistics, by which alone can be measured the influence exerted by the various conditions affecting the public health. With no knowledge of the numbers of births and deaths, and of the ages at death, there obviously can be no knowledge of the rate of infantile mortality; and consequently where this is high, but unrevealed, the public mind is not disturbed. Even where vital statistics are registered and the rates of infantile mortality are therefore known, it is far from being well understood how many lost lives might easily have been saved. In some places, however, in this country and abroad, where this waste and its cause have been properly emphasized and brought home to thinking people, much has been done for its prevention, and thousands upon thousands of lives have undoubtedly been saved thereby.

The registration States of the United States are few: excepting Michigan, Indiana and the following, which recently have been added, California, Colorado, and South Dakota, they lie east of Ohio and north of Virginia—a small corner which includes New England, New York, New Jersey, Pennsylvania, Maryland, and the District of Columbia. According to the Census of 1900, the infantile mortality per thousand births in what then made up the registration area was as follows:

TABLE I.

District of Columbia	274.5	New York	159.8
Rhode Island	197.9	Connecticut	156.8
Massachusetts	177.8	Maine	144.1
New Hampshire	172.0	Vermont	122.1
New Jersey	167.4	Michigan	121.3

One is struck with the difference between the highest and the lowest of these figures: the former is more than twice as great as the latter; and one can but wonder what figures from every State would show and how wide would be the variation between the highest and the lowest.

As infantile mortality figures run in foreign countries, these rates, high as they are, are not extraordinary. The highest about equals that of Russia, and is not much greater than that of Austria; Rhode Island makes a better showing than Germany and Italy, and almost as good a one as Holland and Spain; New Jersey's rate is practically the same as that of France and better than that of Switzerland; Maine stands with England and Wales and better than Belgium and Denmark; Michigan, the lowest in the list, stands with Scotland. Of European countries, but three,[1] Ireland, Norway, and Sweden, have a lower rate than Michigan.

Outside the registration area, there are many cities and towns which collect their own vital statistics, and from their returns one can form some idea of what would be revealed were all of the States to adopt registration. The report of the Census of 1900 includes returns from no fewer than 106 cities and towns with infantile death-rates in excess of 175. In nine cases, the rate exceeded 300; in ten, it was between 250 and 300; in thirty-eight, it was between 200 and 250; and in forty-nine, it was between 175 and 200. These returns are shown in the following table:

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[1] Ireland, average of twenty years, 1874 to 1893, 96.6; Norway, 1902, 75.08; Sweden, 1902, 107.

TABLE II.

Charleston, S. C.	419.5
Savannah, Ga.	387.5
Mobile, Ala.	344.5
Key West, Fla.	311.8
Biddeford, Me.	311.6
Atlanta, Ga.	306.0
Fall River, Mass.	304.7
Lynchburg, Va.	301.7
Richmond, Va.	300.7
Laconia, N. H.	294.6
Shreveport, La.	293.5
Jacksonville, Fla.	287.6
Norfolk, Va.	284.6
Lowell, Mass.	275.5
Washington, D. C.	274.5
Petersburg, Va.	265.1
Nashua, N. H.	261.2
Natches, Miss.	256.3
Alexandria, Va.	250.0
Burlington, Vt.	248.3
Salem, Mass.	247.7
Memphis, Tenn.	247.1
Lawrence, Mass.	246.5
Carlisle, Pa.	245.4
Saratoga Springs, N. Y.	244.9
Steelton, Pa.	244.6
Manchester, N. H.	238.4
Owasso, Mich.	237.3
Baltimore, Md.	235.1
Woonsocket, R. I.	233.8
Annapolis, Md.	233.5
Wilmington, N. C.	232.2
Lansingburg, N. Y.	230.8
Troy, N. Y.	229.5
New Orleans, La.	229.2
Nashville, Tenn.	228.9
Passaic, N. J.	227.9
Leadville, Col.	226.6
New Bedford, Mass.	222.9
Augusta, Me.	219.4
Watertown, N. Y.	219.4
Atlantic City, N. J.	215.4
Raleigh, N. C.	215.4
Providence, R. I.	214.9
Altoona, Pa.	214.8
Phœnixville, Pa.	206.7
Pottstown, Pa.	204.1
San Antonio, Tex.	203.9
Holyoke, Mass.	203.4
Poughkeepsie, N. Y.	202.6
Evansville, Ind.	202.4
Detroit, Mich.	201.2
Philadelphia, Pa.	201.9
Plymouth, Pa.	201.4
Wilmington, Del.	200.9
Richmond Borough, N. Y.	200.4
Hudson, N. Y.	200.0
Albany, N. Y.	199.6
Johnstown, Pa.	199.2
Reading, Pa.	198.9
Brooklyn, N. Y.	197.2
Vincennes, Ind.	197.0
Binghamton, N. Y.	196.9
Sault Ste. Marie, Mich.	196.9
Jersey City, N. J.	196.4
Portland, Me.	195.9
Boston, Mass.	194.1
Traverse City, Mich.	192.8
Allentown, Pa.	192.5
Plymouth, Mass.	192.1
Borough of Manhattan	190.9
Waterbury, Conn.	190.7
Paterson, N. J.	190.5
Milwaukee, Wis.	190.2
Newport, Ky.	189.8
New York, N. Y.	189.4
Kansas City, Mo.	186.8
Cambridge, Mass.	186.5
Norristown, Pa.	186.4
Auburn, N. Y.	186.2
Dover, N. H.	186.0
Elizabeth, N. J.	185.6
Cleveland, O.	185.5
San Diego, Cal.	185.5
New Britain, Conn.	184.9
Easton, Pa.	184.4
Leavenworth, Kan.	184.4
Mt. Carmel, Pa.	183.4
Covington, Ky.	182.8
Newark, N. J.	182.0
Central Falls, R. I.	181.5
Pittsburg, Pa.	180.5
Phillipsburg, Pa.	180.0
Pawtucket, R. I.	179.5
Kingston, N. Y.	178.8
Lawrence, Kan.	178.8
South Bethlehem, Pa.	178.7
Pueblo, Col.	178.4
Hartford, Conn.	178.2
Allegheny, Pa.	178.0
Lima, O.	177.8
Sacramento, Cal.	177.7
Oskaloosa, Iowa.	177.6
Columbus, Ind.	177.2
McKeesport, Pa.	177.0
Los Angeles, Cal.	175.1

II. LEADING CAUSES.

It is unfortunate that while these figures reveal a most lamentable waste of infant life, no details are given from which one can determine its causes, and we are compelled, therefore, to have recourse to the statistics of other countries for an explanation.

In France, the average infantile death-rate for the twenty years from 1874 to 1893 was 167; in 1903 it had fallen to 137. In some cities the rate was very low, thus: Lyons, 110; Bordeaux, 112; Paris, 101. In fact, Paris had then and has now a lower rate than any large European city. In January, 1901, Balestre and Gilletta de Saint Joseph[1] presented to the Academy of Medicine a memoir on infantile mortality in France from 1892 to 1897, in which they showed that the chief cause of death was gastrointestinal diseases. Of each thousand deaths, 385 were due to this group, 171 to congenital debility, 147 to respiratory diseases, 50 to acute contagious diseases, 25 to tuberculosis, and 222 to all other causes. In certain cities, the diarrhœal mortality per thousand deaths below 1 year was found to be as shown in Fig. 1.

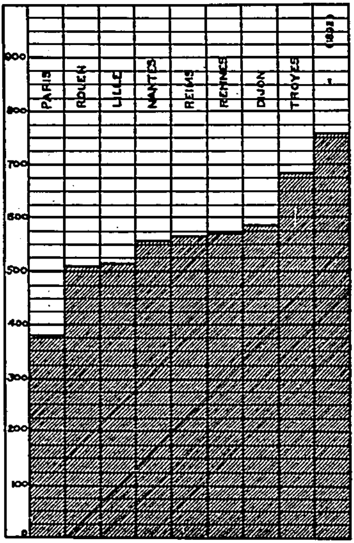

FIG. 1.—Proportion of deaths from diarrhœal diseases per thousand in various French cities. (After Perret.)

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[1] M. Perret, Revue d'Hygiène et de Méd. Infantiles, 1905, iv, 160.

According to Dr. E. Ausset,[1] from 1897 to 1902, of every thousand infantile deaths in the Department of the North, 359 were due to diarrhœal diseases, 169 to congenital debility, and 160 to acute respiratory diseases. The following table shows the rate of diarrhœal diseases per thousand, which obtained in certain parts of the Department.

TABLE III.

District of Dunkerque	445.08
Canton Bergues	410.61
Canton Bourbourg	485.38
Canton Wormhoudt	602.86
Canton Gravelines	404.40
The 2 Cantons of Dunkerque	465.00
District of Lille	401.26
Canton Armentières	416.66
Canton Quesnoy-sur-Deule	420.28
Canton Seclin	383.37
Canton Lannoy	398.87
Canton Roubaix	464.33
The 3 Cantons of Tourcoing	457.77
The 8 Cantons of Lille	427.83
District of Hasebrouck	395.20
Canton Merville	363.60
Canton Steenvoorde	394.44
Canton Cassel	454.66
The 2 Cantons of Bailleul	431.11
District of Valenciennes	313.92
Canton Denain	342.10
Canton Condé	337.07
Canton Bouchain	392.40

Of the European countries, Germany stands second in high infantile mortality, being surpassed only by Russia, where in some districts the rate exceeds 500 per thousand births, and in the whole country it reaches 270. The German rates for the five years 1901 to 1905 were as follows: 216, 184, 202, 204, 204. They were especially high in Bavaria, Saxony, Saxe-Altenburg, and the Reuss principalities. In 1903, for example, the rates were as follows: Bavaria, 264; Saxony, 247; Saxe-Altenburg, 266; Reuss, elder line, 247; Reuss, younger line, 250.

In 1904, in the 323 German cities and towns having populations exceeding 15,000, the rate was 202; in 1905, it was 204. In the same year, the 42 cities with populations exceeding 100,000 showed a rate of 204, and in the twelve months ended June 30, 1906, one of 198. Table IV shows the number of births, the number of deaths under one year, and the infantile death-rates of each of these cities for both periods. Of 67,633 infant deaths, 28,422 were due to diarrhœal diseases.

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[1] Revue d'Hygiène et de Méd. Infantiles, 1905, iv, 433.

TABLE IV.

Place.	Number of births.		Deaths under 1 year.		Infantile death-rates.		
	1904.	July 1, 1905, to July 1, 1906.	1904.	July 1, 1905, to July 1, 1906.	1904.	July 1, 1905, to July 1, 1906.	Difference.
Aachen	4,445	4,300	898	839	202	195	—7
Altona	4,534	4,405	833	749	184	169	—15
Barmen	4,902	4,597	681	605	139	132	—7
Berlin	48,842	49,708	9,782	9,933	200	200	
Bochum	4,060	5,060	718	818	177	162	—15
Bremen	6,294	6,429	1,072	1,116	170	174	+4
Breslau	14,357	14,366	3,393	3,511	236	244	+8
Brunswick	3,684	3,397	672	668	182	197	+15
Cassel	3,080	3,202	502	407	163	127	—36
Charlottenburg	4,703	5,189	811	803	172	155	—17
Chemnitz	8,178	8,314	2,509	2,253	307	271	—36
Cologne	15,137	15,373	3,435	3,266	227	212	—15
Crefeld	2,769	2,752	469	390	169	142	—27
Dantzig	5,209	5,288	1,143	1,286	219	243	+24
Dortmund	6,751	7,385	1,199	1,366	178	185	+7
Dresden	15,153	14,297	2,914	2,735	192	191	—1
Duisburg	4,380	7,524	845	1,137	193	151	—42
Düsseldorf	8,524	8,868	1,736	1,667	204	188	—16
Elberfeld	5,151	4,963	796	739	155	149	—6
Erfurt	2,765	2,960	574	597	208	202	—6
Essen	8,061	9,494	1,325	1,498	164	158	—6
Frankfort a. M.	9,146	9,355	1,458	1,446	159	155	—4
Gelsenkirchen	7,541	7,451	1,335	1,169	177	157	—20
Halle	4,982	4,985	1,141	1,175	229	236	+7
Hamburg	19,883	20,471	3,321	3,538	167	173	+6
Hannover	6,550	5,908	1,100	949	168	161	—7
Karlsruhe	3,137	3,052	656	565	209	185	—24
Kiel	4,817	5,083	837	903	174	178	+4
Königsberg	5,839	6,671	1,149	1,556	197	233	+36
Leipzig	14,739	14,734	3,576	3,273	243	222	—21
Magdeburg	6,372	6,304	1,611	1,472	253	234	—19
Mannheim	5,176	5,170	1,196	1,053	231	204	—27
Munich	16,743	15,787	3,831	3,432	229	217	—12
Nuremberg	10,182	10,290	2,707	2,547	266	248	—18
Plauen	3,744	3,745	859	779	229	208	—21
Posen	5,008	5,123	1,112	1,272	222	248	+26
Rixdorf	4,530	5,547	996	1,212	220	218	—2
Schöneberg	3,021	3,200	459	480	152	150	—2
Stettin	7,497	7,069	1,984	1,847	265	261	—4
Strasburg	4,768	4,794	966	913	203	190	—13
Stuttgart	5,501	6,176	1,018	1,270	185	206	+21
Wiesbaden	2,370	2,489	347	403	146	162	+16
Total	332,525	341,295	67,966	67,637	204	198	—6

From the very admirable registration returns, it is possible to determine the diarrhœal infantile death-rate of each city, and the percentage responsibility of the diarrhœal diseases in the production of the high general mortality. Table V presents these figures for the twelve months ended June 30, 1906.

In Table IV, it will be noted that one city, Chemnitz, had in 1904 the unenviable distinction of an infantile death-rate of more than 300. In Table V, it will be observed that the same city leads all others in its diarrhœal rate, 135.67, which surpasses the total infantile death-rate of Barmen (131.61) and of Cassel (127.11). Indeed, it is higher than the rate from all causes for England and Wales in 1903 (125), for Scotland in any one of fifty years, the highest record for that country being an average of 128 for the decade, 1891 to 1900; for Norway (average of twenty years, 1874 to 1893, 105; 1902, 75.5); for Sweden (average of twenty years, 1874 to 1893, 118; 1902, 107); Ireland (average of twenty years, 1874 to 1893, 96.6); and is almost as high as the total rate for France (1903, 137) and for all Danish cities in 1903 (137.6).

TABLE V.

Place.	Infantile death-rate.	Diarrhœal infantile death-rate.	Percentage of infant deaths due to diarrhœal diseases.
Aachen	195.12	78.60	40.28
Altona	169.12	38.37	22.69
Barmen	131.61	47.64	36.20
Berlin	199.83	87.99	44.03
Bochum	161.66	50.20	31.05
Bremen	173.59	73.92	42.92
Breslau	244.39	98.62	40.36
Brunswick	196.64	81.22	41.32
Cassel	127.11	31.85	25.06
Charlottenburg	154.75	54.35	35.12
Chemnitz	270.99	135.67	50.07
Cologne	212.45	93.60	44.06
Crefeld	141.71	53.42	37.69
Dantzig	243.19	109.87	45.18
Dortmund	184.96	61.75	33.38
Dresden	191.29	83.23	43.51
Duisburg	151.12	97.38	44.59
Düsseldorf	187.97	82.43	43.85
Elberfeld	148.90	50.97	34.23
Erfurt	201.69	42.90	21.27
Essen	157.78	66.67	42.26
Frankfort a. M.	154.67	53.13	34.30
Gelsenkirchen	156.89	58.11	37.04
Halle	235.71	124.77	52.94
Hamburg	172.83	70.98	41.07
Hannover	160.63	37.41	23.28
Karlsruhe	185.12	86.17	46.55
Kiel	177.65	72.99	41.08
Königsberg	233.25	113.47	48.65
Leipzig	222.14	121.49	54.69
Magdeburg	233.52	100.73	43.14
Mannheim	203.67	86.46	42.45
Munich	217.39	95.33	44.14
Nuremberg	247.53	113.80	45.97
Plauen	208.01	35.25	16.95
Posen	248.29	92.52	37.27
Rixdorf	218.49	103.66	47.44
Schöneberg	150.00	49.38	33.13
Stettin	260.54	112.28	43.09
Strasburg	190.45	92.82	48.74
Stuttgart	205.63	74.80	36.38
Wiesbaden	161.91	49.42	30.52
Average	198.16	80.34	24.03

It will be noted, further, that three of these German cities, Chemnitz, Halle, and Leipzig, all had a diarrhœal death-rate (135.67, 124.77, and 121.49) higher than the latest obtainable rates for all causes for the cities of Christiana (102), Lyons (110), Bordeaux (112), Amsterdam (116), Stockholm (118), Zurich (107), Geneva (117), and Basel (120).

An average diarrhœal rate of 80.34 for the forty-two leading German cities may well cause public authorities, not alone in Germany but everywhere, to stand aghast; and especially where no records are kept, to wonder what careful and systematic registration would reveal. In these forty-two cities we find that more than two-fifths of the infantile mortality is due to diarrhœal diseases, a considerably higher rate than obtains in France.

If we take the statistics of the same place for a series of years, we find that any considerable fluctuations in the rate from all causes are due chiefly to differences in the diarrhœal rate alone, the rate for all other causes varying comparatively little from year to year. This is shown, for example, in the case of Berlin, in the following table:

TABLE VI.

	Births.	Deaths.	Rate.	Diarrhœa.	Per cent.	Other causes.
1900	49,834	11,762	236.02	4,743	40.32	7,019
1901	50,453	11,325	224.46	4,783	42.14	6,542
1902	49,356	8,927	180.87	2,417	27.07	6,510
1903	47,802	9,452	197.73	3,199	33.84	6,253
1904	48,885	9,783	200.12	2,846	29.09	6,937

Taking the years with the highest and lowest percentage mortality from diarrhœa, 1901 and 1902, we note that while the difference in percentage is large (15.07), the number of deaths from all other causes is practically the same; and we note, further, that, whereas the difference between the highest and lowest number of diarrhœal deaths for the five years is 2366, the figures for deaths from all other causes have an extreme range of 766.

Let us return for a moment to the American and German returns set forth in Tables II and V.

The infantile death-rates of German cities of more than 100,000 population, during the twelve months ended June 30, 1906, which, as a rule show an improvement over those obtaining in 1904, include not one in excess of 300; our meagre returns show no fewer than nine, with one in excess of 400. The highest German rate is that of Chemnitz (270.99), which rate is surpassed by no fewer than fifteen of our registration cities and towns. Only two of the forty-two German cities in Table V show a rate higher than 250; Table II shows nineteen. Seventeen of the German cities show rates higher than 200; our returns show fifty-seven. It is true that, in making these comparisons, we are dealing not with populations of the same size, the German cities having populations in excess of 100,000 and ours being, in most cases, far smaller; but the home returns are the best available and suggest that with universal registration, our showing would be anything but satisfactory and commendable. And it would seem probable, too, that complete returns would show the same enormous influence of diarrhœal diseases and of artificial feeding that is shown in those countries which give these matters proper consideration and study.

III. SEASONAL DISTRIBUTION.

When we study the seasonal distribution of infantile mortality, we find enormous fluctuations, the summer months showing a sudden upward curve and the autumn months an equally sharp decline.

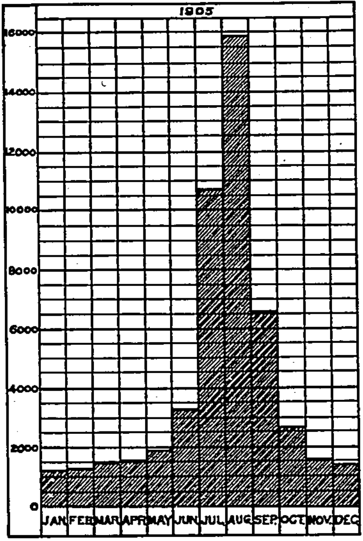

FIG. 2.—Number of deaths from diarrhœal diseases in German cities and towns of more than 15,000 people, by months.

Thus, in 1905, in the German cities and towns with populations exceeding 15,000, there were registered 628,060 births and 128,035 deaths under one year, a rate per thousand of 203.8. The deaths from diarrhœal diseases ranged, according to months, from 1192 in January to 15,863 in August, after which month there was a sharp fall. The rise and fall are shown in Fig. 2.

It will be observed that Fig. 2 has to do with deaths from diarrhœal diseases alone. Fig. 3 shows the total infantile mortality and the diarrhœal mortality in German cities of more than 100,000 people, by months, during the twelve months, July, 1905, to June, 1906, inclusive, the double hatching indicating diarrhœal mortality.

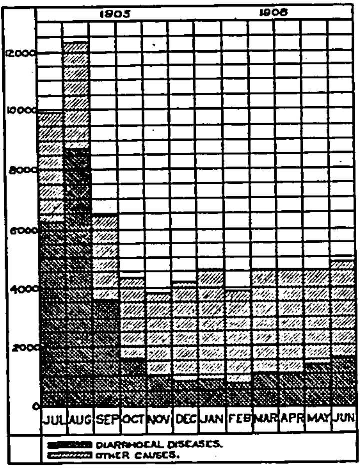

FIG. 3.—Infantile mortality of all German cities of more than 100,000 population, from diarrhœal and non-diarrhœal diseases, by months.

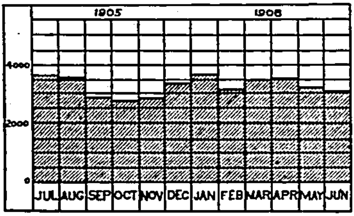

FIG. 4.—Infantile mortality of all German cities of more than 100,000 population from non-diarrhœal diseases, by months.

Still further to illustrate the comparatively constant death-rate from non-diarrhœal causes, Fig. 4 is presented.

Referring to Table V, it will be observed that the city which showed the highest percentage mortality from diarrhœal diseases was

Leipzig. A study of its birth-rate, its infantile death-rate, and its diarrhœal infantile death-rate, by months, reveals the fact that, in August, the proportion of deaths to births was 570:1000, and of diarrhœal deaths to births, 430:1000, whereas in February the proportions were, respectively, 131:1000 and 37:1000. The two rates by months are shown in Fig. 5.

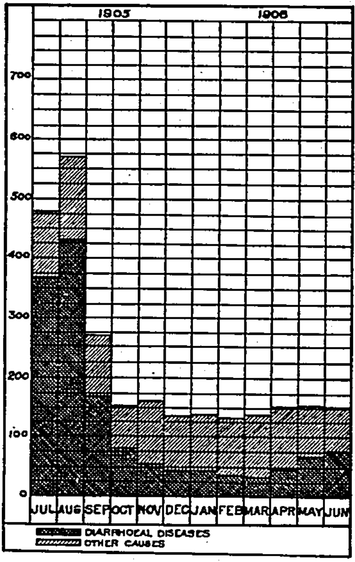

FIG. 5.—Infantile death-rates and diarrhœal infantile death-rates of Leipzig, by months.

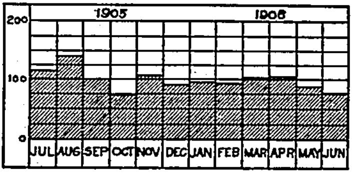

FIG. 6.—Non-diarrhœal monthly infantile death-rates of Leipzig.

That the non-diarrhœal death-rates of a city are subject to no very wide fluctuations from month to month is shown graphically by Fig. 6.

From the facts and figures thus shown it might be inferred that all infants under one year of age are in great danger during the hot summer months, but this is far from being the case. Not the three summer months, but the first three months of life are the dangerous period. The report of the Registrar-General of England and Wales for 1904 shows that 49 per cent. of the infantile mortality occurs during the first three months; 20 per cent. in the second three months, and 31 per cent. in the third and fourth three months of life. In Berlin, in 1904, of 9783 infant deaths, 3175 occurred in the first month of life; 1120 in the second, and 949 in the third; thus, 5244, or 53.6 per cent. occurred in the first three months. In 1903, of 9492 deaths, 5206 (or 55.08 per cent.) occurred in the same period. The percentage for the years 1900, 1901, and 1902 were respectively 53.21, 53.47, and 55.83. And yet, in Germany, in 1905, 41.37 per cent. of the infantile mortality occurred in the months of July, August, and September, and of the 52,966 deaths which then occurred, no less than 62.8 per cent. were due to diarrhœa. How then can this seasonal distribution and the age-periods be reconciled? The answer is by no means difficult. In the first place the cause of infantile mortality that stands second to diarrhœal diseases is set forth as congenital debility. It knows no season and its victims, whether born in January or August, die largely on their first day and in their first week or month. These deaths are naturally distributed fairly evenly throughout the year, and those from other non-diarrhœal causes which have seasonal fluctuations tend to balance one another and maintain a fairly even line. With the vast majority of the others the chances of life and death depend upon the method of feeding, and the older an infant is when hot weather comes on, the better its chance of life; for after eight or nine months of life the possibility of going through a hot summer unharmed, however fed, is vastly greater than that of the infant born in spring or summer and fed artificially.

IV. INFLUENCE OF METHOD OF FEEDING.

In 1903, the Prussian infantile death-rates ranged from 143.82 for Barmen to 357.18 for Dantzig. In 1904, Barmen was again the lowest with 139, and for the twelve months ended June 30, 1906, was surpassed in this respect only by Cassel, which city had made great improvement over its record for 1904, 127 against 163. The enviable position of Barmen in this particular is attributed by Kriege and Sentemann[1] chiefly to the high percentage of breast-feeding, namely, 63, with 15 per cent. partially breast-fed and 22 per cent. bottle-fed. In the city of Graz, in the years 1903 and 1904, there were, according to K. Helle,[1] 170 deaths of infants from diarrhœal disease. Of this number but 4 were breast-fed, 48 were partly breast-fed, 117 were wholly bottle-fed, and in one case the method was unknown.

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[1] Centralb. f. allg. Gesundheitspflege, 1906, xxv.

In Australia the authorities are gravely concerned. According to Dr. A. J. Turner,[2] during the summer months, in Brisbane, more than half of the bottle-fed babies die; and Dr. Eleanor Bourne, of the Brisbane Children's Hospital, says that the majority of babies entered suffer "from the effects of improper feeding and nothing else." And Mr. P. E. Muskett, of Sydney, has asserted that of 303,070 infants dying in Australia and New Zealand in the course of 19 years prior to 1903, half might have been saved.

Dr. Arthur Newsholme,[3] M. O. H. for Brighton, England, asserts that breast-fed infants contribute but one-tenth of the diarrhœal infantile mortality, and Dr. W. J. Tyson,[4] states that three-fourths of the 150,000 infants dying annually in Great Britain from all causes are bottle-fed. Dr. G. F. McCleary,[5] M. O. H. for Hampstead, says that the infantile mortality dependent upon defective infant feeding is, broadly speaking, a mortality of hand-fed infants.

Dr. J. E. Sandilans,[6] inquiring into the method of feeding of 695 infants in the Borough of Finsbury during the first nine months of life, ascertained that of the 139 that died of diarrhœal diseases, but 16 per cent., and of those that survived, 69 per cent., were breast-fed.

In Munich, in 1903, of the 4075 infants that died, investigation showed that 3395 (or 83.3 per cent.) were artificially fed. Most striking and instructive of all, however, are the facts revealed by the very admirable statistical returns of the city of Berlin, and by the researches of Budin concerning the infantile mortality of Paris during 1898. From the former it appears that in Berlin during the five years 1900 to 1904 less than one-tenth of the infantile mortality occurred among those fed solely at the breast. The figures for each year are shown in Table VII.

TABLE VII.

Year.	No. of deaths of infants whose method of feeding was ascertained.	Number breast-fed.	Percentage solely breast-fed.	All others.
1900	9558	895	9.36	90.64
1901	9338	856	9·17	90.83
1902	7027	768	10.90	89.10
1903	7680	723	9.41	90.59
1904	7780	753	9.68	90.32

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[1] Archiv. f. Hygiene, 1905, lvi, 18.

[2] Lancet, 1906, i, 1438.

[3] Journal of Hygiene, April, 1906.

[4] Journal of State Medicine, September, 1904.

[5] Lancet, Aug. 18, 1906.

[6] Journal of Hygiene, January, 1906.

Budin's research concerning the infantile mortality of Paris during 1898, shows not only the enormous preponderance of deaths among the artificially fed, but its seasonal and weekly distribution (Fig. 7).

V. CLASS MORTALITY.

High infantile mortality is largely a class mortality, as is evident when one studies the returns of individual communities. It is highest, as a rule, in cities and towns whereof the population is largely ignorant and poor and where women are employed to a great extent in mills and other industrial establishments and help in this way to pay the family expenses. When pregnant, they work as long as possible up to the time of confinement, after which they return as soon as they can, leaving their offspring to the care of others and to be brought up on the bottle. In Massachusetts, for example, the cities with the highest infantile mortalities, as shown in Table II, are "mill towns;" those with the lowest are chiefly

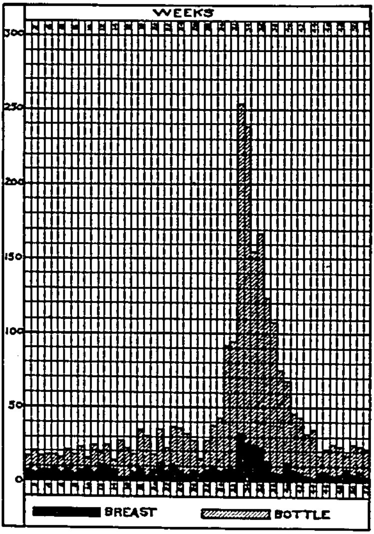

FIG. 7.—Infantile mortality of Paris during 1898, by weeks, showing influence thereon of artificial feeding. (M. Perret, Revue d'Hygiène et de Médecine Infantile, 1905, iv, 167.)

residential in character and hold out no opportunities for the employment of married women, or their industries are of such a nature that the male wage-earners can properly maintain their wives at home as helpmeets in the true sense of the term. In other States and in foreign countries the same is commonly true; but in some of the States with large negro populations, ignorance and poverty have an equal or greater influence.

At the National Conference on Infantile Mortality held in London in June, 1906, Dr. George Reid[1] contrasted the infantile mortality of two districts, identical in health conditions, but with the important difference that, in one, women are largely employed in industrial pursuits, whereas, in the other, where mining and iron-working are the principal industries, there is practically no employment for them. From figures obtained from the Registrar-General, he classified the artisan towns into three groups:

I. Those in which the proportion of employed married and widowed females between the ages of eighteen and fifty years reached or exceeded 12 per cent. of the total number of women of those ages; II, those in which the proportion was from 6 to 12 per cent.; and III, those in which it was below 6 per cent. In group I, the infantile mortality was highest and in group III, it was lowest; and this order was found to obtain constantly since 1881. Thus, in the decades 1881 to 1890, 1891 to 1900, and four-year period 1901 to 1904, the average yearly infantile mortality rates of group I, were 195, 212, and 193; of group II, 165, 175, and 156; and of group III, were 156, 168, and 149.

Further, to illustrate the fact that we are dealing with a class mortality may be instanced the observations of K. Helle,[2] concerning the station of 170 infants that died of diarrhœal diseases in Graz during 1903 and 1904. Not one belonged to a rich family, and but 9 to the well-to-do class; whereas, 49 were of the poor, and 112 of the very poor. Thus the percentage division among the four classes was respectively 0, 5.3, 28.8, and 65.9. Again, according to H. Neumann,[3] in Berlin, in 1903, of 2701 infantile deaths investigated, 1792 occurred in one-room dwellings, 754 in two-room, 122 in three-room, and 43 in larger dwellings.

Illegitimacy, where common, has doubtless a very great influence generally on infantile mortality, and yet in some foreign communities where foundlings are cared for in institutions the mortality of this unfortunate class is smaller than that of the legitimate.

VI. INSANITARY DAIRYING.

Returning now to the consideration of methods of feeding, the question arises as to why the artificially-fed show so much higher mortality figures than the breast-fed. In the first place, each mammalian species has its own natural food supply. The natural food of the infant is human breast-milk, which differs materially in character and composition from cows' milk, which is the principal substitute therefor. It differs chiefly in the character of its proteids and to a slight extent in the nature of its fat; but by means of the well-known method of modification, cows' milk can be converted into an acceptable substitute, provided it is of proper quality. Most unfortunately, however, cows' milk is almost universally far from being of proper quality when it reaches the home of the consumer in large cities and towns, and even in the rural districts where it is produced. Indeed, it is unfit for infants' use in the great majority of cases before it leaves the premises where it is drawn, for the conditions which obtain at dairies generally in all the countries of the world, with few exceptions, are such as to insure its immediate seeding with various species of harmful bacteria; that is to say, the great majority of dairies are dirty in appointments and methods.

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[1] Lancet, 1906, ii, 423.

[2] Archiv. f. Hygiene, 1906, lvi, p. 15.

[3] Deut. med. Woch., 1904, p. 1723.

In this country wherever public authorities and private associations have undertaken investigations of the conditions under which the public milk supply is raised, these have been found to be often of the most revolting character, and in a number of States and cities much is being done in the line of compelling improvement. Often the objectionable conditions are evenly distributed throughout the dairy: everything is dirty—the premises as a whole, the barn, the litter, the cows, the milkers, the utensils, the water supply, and every process from the cow to the can. Where everything is dirty, and carelessness in handling is the rule, it is hardly to be expected that the product will be clean and wholesome; and when to the original handicap are added the changes due to improper conditions during long transportation and storage, frequent handling, common methods of adulteration, and lack of care at the point of final delivery, it is not a subject for wonder that when it reaches the stomach of the infant it has acquired a more or less poisonous character.

In England the conditions of dairying are, if anything, far worse than in this country, owing largely to the extent to which local authorities are bound by official red tape. The milk of London, for example, comes largely from a distance and is subject to no control whatever by the metropolitan authorities; and even where it is produced the local authorities are equally without power. According to Dodd,[1] the steps necessary to stop the introduction into London of an infected milk supply include the obtaining of an order of inspection from a justice in the district where the farm is situated, inspection by a veterinary surgeon, report to the authority, service of notice on the farmer to appear and show cause why his milk should not be excluded from sale, and condemnation by the authority. But even then the dairyman may refuse to allow inspection on pain of summons and fine of not exceeding five pounds, and in the meantime may sell his diseased cows to another, whereupon, the process must begin again as before. Moreover, inasmuch as London comprises no fewer than 29 districts, in order to exclude an infected supply from every part of the metropolis, it would be necessary for the 29 medical officers to go to the place of production and obtain 29 separate orders of inspection, 29 reports, 29 orders of notice to show cause, etc. And despite the efforts of the London County Council, in 1902, to acquire authority to exclude infected milk from the whole county of London, the bill was killed in the House of Lords on account of the opposition of certain Borough Councils. The provincial sanitary authorities are equally powerless, for although under the Infectious Diseases Prevention Act of 1890 they can exclude infected milk, they must first give notice to the County Council concerned and to the Local Government Board and must withdraw the order when the Sanitary Authority or Medical Officer of Health is satisfied that the supply is changed or the source of infection is removed, perhaps to another county. Dodd says that these orders are, generally speaking, a dead letter in most rural districts, since the local authorities will not enforce them, because they are not for the benefit of their own but of distant populations.

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[1] The Problem of the Milk Supply, London, 1904.

In this country, happily, these things are better ordered in those States which have adequate health laws. In Massachusetts, for example, the local board of health of even the smallest town has power to exclude from its markets the milk of an infected or simply dirty dairy, whether that dairy be local or far distant, and without anything more than its own order.

One may obtain a fair idea of the conditions which obtain in English dairies by reference to reports and papers presented by various health officers and other writers. Dr. Groves[1] says: "The conditions under which milk is collected in this country, especially by small dairymen, are simply too awful." Hime,[2] describing conditions as he found them at the farms which supplied Bradford with milk, states that he saw children's napkins washed in milk-cans, and "once I saw articles even yet more foul being washed in a milk-can which was to be used an hour later for dairy purposes." The dairies of Staffordshire appear to be far from deserving commendation. Dr. George Newman[3] quotes the medical officer of Stoke-on-Trent, who stated in his report for 1900 that nearly every cow-shed inspected was overcrowded, badly lighted, and even not lighted at all, unventilated and with air so foul as to repel a visitor, dirty as to walls and floor, undrained, and containing filthy cows and accumulations of manure. Dr. Reid, M. O. H. for Staffordshire, wrote

[1] Journal of the Sanitary Institute, May, 1905, p. 229.
[2] British Medical Journal, 1903, ii, 1669.
[3] Public Health, February, 1904, p. 258.

Newman in June, 1903: "I may mention generally that I very rarely come across a dairy farm which is satisfactory as regards the cowsheds; most are ill-lighted, overcrowded, badly ventilated, and badly drained."

The report on the health of Manchester, for 1902, quoted by Dodd, says that the great majority of the farms of Cheshire, Derbyshire, and Staffordshire are unfit for dairying and that the cows and sheds are very dirty and many of the cows are tuberculous. Newman[1] says that in 1901, 9.2 per cent. of the cows supplying Manchester from outside the city were tuberculous, and, in 1902, 8.4 per cent. The great majority of farms visited were in a very dirty condition, and totally unfit for the production of milk. The veterinary surgeon reported that the Cheshire farms were distinctly bad, but that the farms in Derbyshire and Staffordshire were decidedly worse. Dr. G. F. McCleary,[2] M. O. H. for Battersea, says: "Cows' milk, as usually supplied in this country, may be, and often is, a source of grave danger. It is often grossly contaminated, the contamination taking place at the farm, in transit, in the milkshop, on the milk-round, and last, but certainly not least, in the home of the consumer."

Cumulative evidence concerning the unfitness of English dairies might be quoted almost indefinitely, did space permit, and were it necessary. The conditions obtaining in Ireland are said to be even worse. Thus, Bulstrode and Tunnicliffe[3] have made a very unfavorable report, in which the filthy state of the Dublin dairies comes in for special mention.

In France and Germany, the dairy conditions rank in the main with those of England. The lack of control of French dairies is the chief impelling influence in the establishment of the numerous milk-depots and the furnishing of pasteurized milk to the poor. In Germany, the great majority of dairies are dirty and badly managed, and although many of the cities have established regulations, few enforce them.

According to A. Reinsch,[4] in ninety-five cities with populations in excess of 40,000, eighty-one have milk regulations more or less in agreement, but concerning the presence of dirt these vary widely. Some require that there shall be no visible sediment on standing two hours, others that the amount shall not exceed 15 milligrams per liter; but in sixty-one no attention is paid to the amount of dirt which may be present.

Perhaps the worst conditions as to milk supply are those which obtain in India. According to an article in the *Lancet*,[5] a committee of the Corporation of Calcutta, in a report on the milk supply of that city, stated that in a majority of cases "the cattle were in a filthy condition and were standing in offensive smelling filth inches deep; their udders were covered with muck; the cattle were packed together so closely that there was no room for them to lie down; the sheds were painfully ill-ventilated, the entrances being blocked by platforms on which the cow-men slept, and all the air-holes being closed up with mud bricks," and Mr. D. R. Bardi[1] asserts that in Bombay, where milk is extensively adulterated with polluted water, the infantile death-rate reaches the enormous height of 786.5.

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[1] Loc. cit.

[2] Journal of the Sanitary Institute, May, 1905, p. 225.

[3] Parliamentary Paper. (Cd. 833), Appendix IV.

[4] Die gesetzliche Regelung des Milchverkehrs in Deutschland, Hamburg. 1904.

[5] November 18, 1905, p. 1512.

In the Scandinavian countries, whose infantile death-rates are conspicuously low, even during the hotter months, far more attention is paid to dairy cleanliness and methods than anywhere else in the world, and yet with all their care there is room for much improvement, as one can learn from personal observation at first-class dairy farms and milk-distributing concerns in Denmark.

It may be asked: If infantile diarrhœas are due to milk produced, handled, or stored under improper conditions, why is it that they are so vastly more prevalent in July and August, when, at least, the cows at pasture are more likely to be clean than when housed? Milk produced under ordinary conditions is sure to contain large numbers of bacteria per cubic centimeter before the operation of milking is completed; under favoring conditions these organisms multiply enormously within a few hours; and the one favoring condition of growth is warmth. If milk is cooled at once to 45° F. and kept at about that temperature until needed for use, the original bacteria not only may not have increased materially, but may even have diminished in numbers; but at how many dairies in every hundred is milk properly cooled and to what extent is milk kept cool during long-haul transportation, retail delivery, and home storage? How many small dairymen can afford to use ice when their product yields them so small a margin of profit? How many would use it in any event unless compelled to?

Milk "cooling" in cans immersed in a tub or trough containing water, unchanged, perhaps, for days at a time, and exposed to the rays of the broiling August sun, is a common sight in the country. After collection and delivery at the railroad station, the cans may stand a long time on the platform in the sun, and then may make a long trip in a car not provided with ice. Next comes the handling by the retailer, and perhaps another period of storage in a stable; then delivery of small cans and jars, left on the customers' doorsteps; and lastly, the storage in the home, perhaps without ice—for it must be remembered that cholera infantum is largely a disease of the poor—with exposure to dust and dirt and flies. Under these very common conditions, it is then not strange that a city's milk supply is so often richer in bacteria than its sewage.

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[1] Transactions of the Bombay Medical and Physical Society, vol. ix, No. 1, quoted by the Lancet, 1905, ii, 1853.

Far less infantile diarrhœa occurs in the country than in cities and large towns, in proportion to population, because the milk used in the country is at least comparatively fresh, while that used in the towns is in large part decidedly stale and unfit for drinking. It is hard to convince the dairyman of less than average intelligence that dirt in milk breeds disease. He will tell you that he was brought up on it, as was the entire neighborhood; he points out the living adults and children, forgetting the infant dead; he cannot believe that a mere trace of visible cow-manure can do any harm or that bacteria which are so small that billions of them may be suspended in a teaspoonful of milk, can be large enough to accomplish any results; and he thinks clean milk a fad and complains, with right, as a rule, of the meagre reward of his labors. He has, most likely, no nearby source of ice supply; he cannot buy ice out of his small profits—quite likely he would not buy it any way; and his method of cooling is, in his opinion, quite good enough. And thus it happens that the unequal seasonal distribution of infantile diarrhœa is largely a consequence of inadequate cooling and storage of milk.

VII. POISONOUS AND INFECTED MILK.

Concerning the ways in which milk becomes seeded with bacteria as its place of origin, it is hardly necessary to enlarge, for they are now too well-known to the profession and the intelligent laity; but there are certain points about dirty milk which are not yet generally understood. Not all the bacteria that gain access to milk at the farm are capable of causing injury to the consumer; in fact the great majority of the more than 200 varieties isolated produce no harmful effects. Many species shorten the commercial life of milk by causing souring and coagulation, and these have been likened by Professor Vaughan to the red lanterns used as danger signals on highways. While certain other more hardy forms are secreting or excreting toxic substances, and others of pathogenic nature are multiplying from hundreds to millions and tens of millions, the souring bacteria are manufacturing lactic acid from the milk sugar and bringing about changes in taste and consistence which render the milk non-potable. They are easily destroyed at pasteurizing temperatures which do not affect the growth and activity of the various spore-bearing species, which peptonize and produce toxins; and so in their absence the latter can continue producing changes in milk, which grows more and more stale, and more and more dangerous, without becoming sour; and so long as milk remains sweet, so long is it considered by the world in general as fit for household use.

There is still another group of bacteria commonly present, of vastly more importance than the peptonizing species, namely, the pyogenic species which are associated with that most common of all bovine diseases, garget, or mammitis, and with other similar pathological conditions, as "yellow galt." The most common and most virulent of these is the streptococcus, which finds in warm milk a most favorable culture medium for rapid multiplication. Thus, Petruschky has shown that at room temperature (68° F.) a streptococcal content of 300 per cubic centimeter may increase in twenty-four hours to one of 10,000,000; but the same milk kept at 50° F. yielded but 30,000 per cubic centimeter, or but three one-thousandths as many. Escherich and others have noted the same rapidity of multiplication. Conn states that in fresh milk the majority of bacteria are streptococci, which come from the udder, and others have shown that these organisms may be present in the ducts, even when there is no actual inflammatory process going on. Thus, Uhlmann[1] studied more than 800 sections of 35 teats of cows, goats, and sheep and found bacteria, with micrococci predominating, in every section, and most numerous in the teats from cows. Bergey[2] studied the milk of several cows during an entire period of lactation and concluded that once an udder becomes infected with pyogenic bacteria the infection tends to persist over several periods of lactation. In another investigation in which a large number of milk samples, drawn in sterile tubes, were examined, Bergey[3] found that more than two-thirds contained bacteria, the prevailing forms of which were the pyogenic organisms, more particularly streptococci. Careful study of these organisms revealed no definite difference between them and the streptococci concerned in pathological processes in man. They were found in nearly all the samples which contained pus and in some from cows in which no inflammatory process could be discovered.

Garget being the commonest of bovine diseases, often existing without marked symptoms and only discovered by accident; and the milk of cows with no inflammatory process going on, but with infected milk ducts, often containing pyogenic organisms, one would infer that a large part of the public supply ought to yield considerable numbers of streptococci on bacteriological examination; and the inference would be correct. Bergey[4] found them in half the samples examined from the Philadelphia supply. Rabinowitch found them in abundance in samples from Berlin, even from the model dairies. Kaiser[5] examined 30 samples from Graz and found that all but 7 contained streptococci, either alone or associated with staphylococci and other organisms; that is to say, 76.7 per cent. were infected; and the number of streptococci present ranged from 100,000 to 100,000,000 per cubic centimeter. Eastes[6] examined 186 samples of

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[1] Inaugural Thesis, Jena, 1903.

[2] University of Pennsylvania Medical Bulletin, July-August, 1904.

[3] Pennsylvania State Department of Agriculture, Bulletin 125, 1904.

[4] American Medicine, April 20, 1901.

[5] Archiv f. Hygiene, 1906, lvi, 51.

[6] British Medical Journal, 1899, ii, 1342.

London milk and found streptococci in about the same proportion—75.2 per cent. Foulerton[1] found staphylococci in 28 per cent. and streptococci in 32 per cent. of samples of the supply of Finsbury The worst showing is that made by Leipzig samples in the hands of Brüning;[2] and be it remembered that in Table V the city showing the highest percentage of infantile deaths due to diarrhœal diseases is Leipzig. Brüning found streptococci in numbers ranging from 100 to 1,000,000 per cubic centimeter in 26 of 28 samples (93 per cent.).

The pyogenic bacteria are by no means the sole exciting causes of infantile diarrhœas, although they appear to be very largely responsible. In addition to these and the peptonizing species are the several types of the dysentery bacillus, Proteus vulgaris, Bacillus pyocyaneus, and others. Nor are the summer diarrhœas the only disturbances caused by streptococci and other bacteria; but these concern children of larger growth and adults.

VIII. THE REMEDY.

What is the cure for the annual waste of human life due to stale and infected market milk? The most obvious answer would be the discontinuance of cows' milk in feeding infants, but unfortunately, bad as it is, it is the only available substitute or basis for a substitute for human milk. Then why not encourage breast-feeding? It is an unfortunate fact that a very large proportion of mothers cannot, if they would, suckle their offspring, owing to their own physical defects, which are largely hereditary. Von Bunge's statistics, drawn from all parts of Europe, show that women unable to nurse are commonly daughters of alcoholics, and he states that if two generations have been alcoholic, the third will almost certainly be unable to suckle their children. The proportion of mothers defective in this respect is commonly stated to be about half, but Bunge asserts it to be not more than a quarter.

In the lower strata of society, breast-feeding is to a large extent interfered with by the economical and sociological conditions which compel married women to work in industrial establishments, and in the upper strata it is neglected on account of its interference with what are miscalled social duties. The employment of married women may or may not be necessary, but the observation of the Rt. Hon. John Burns, President of the Local Government Board, at a national conference on infantile mortality, held in June, 1906, that it tends to make loafers of the husbands and hoodlums of the children, who lose the restraining influence of a mother's constant care, is doubtless true. He asserts that infantile mortality often rises with full employment and high wages, because of greater opportunities for obtaining alcoholic drink, and falls with poor trade.

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[1] Brit. Med. Jour. 1904, ii, 424.

[2] Jahrbuch f. Kinderheilkunde, 1905, lxii, No. 1.

"Married women's labor makes loafers, is an individual injury, a social mistake, and a commercial blunder."

In France and Italy, the advantages of breast-feeding receive governmental and commercial recognition. In France, it is a common practice in factories to post placards proclaiming the advantages of breast-feeding and offering every facility to women to nurse their infants, including special rooms, and the women are allowed leave of absence at intervals for this purpose. In Italy such a room is obligatory in every establishment employing more than fifty women. In Vienna, an association of physicians and others has been formed to encourage suckling and to instruct mothers concerning the relation of methods of feeding to infantile mortality.

It has been observed that infant mortality among the Jews is comparatively low, and the reason therefor is doubtless the fact that among that race it is regarded as disgraceful for a man to allow his wife to work in a factory and deprive her children before their birth and afterward of a mother's care.

In view of the inability plus uncompromising disinclination of a large proportion of mothers to nurse their infants, it becomes necessary to choose the best available substitute, which happens to be cows' milk. Now, cows' milk, as we have learned, is, generally speaking, a dirty substance, unsuited hygienically or esthetically to use as a human food. Fortunately, its pathogenic power can be removed or very greatly impaired by heating, for it appears on the evidence to be true that the toxic substances of stale milk are destroyed like the pathogenic organisms of infected milk in the process of pasteurization. But is pasteurization the remedy? Is it not better to start with a clean supply than to sterilize the pus and dung just before consumption? Besides, the ignorant poor will not pasteurize milk with any regularity or great care, and too much reliance should not be placed upon municipal milk stations and philanthropic distribution.

Space will not permit, nor is it necessary to enter upon, a discussion of the injurious influence of pasteurization upon the natural properties of unheated milk; nor can the question of milk stations and "gouttes de lait" be considered here, however valuable we recognize these institutions to be; and this paper will close with a plea for clean milk at the farm and proper methods of transportation, storage, and delivery.

Who is to blame for dirty milk? Those unfamiliar with the conditions will answer that it is the farmer. While it is true that the original seeding, either with the pus and streptococci of garget or with the hundreds of varieties of bacteria incidental to dusty and dirty cow-barns, cow-dung, dirty clothes, dirty hands, dirty cows, dirty utensils, and dirty methods, takes place at the farm, the real responsibility lies with the consumer and the middleman. The consumer is disinclined to pay a fair price for this valuable article of food. Everything else may advance in price—meats, coal, sugar, gasolene, wages, oats, pearls, and theatre tickets—and the advance is met with at most some futile grumbling; but whenever a rumor goes out that milk is to cost an extra cent per quart, loud outcries are heard and always, ostensibly, on behalf of the poor. We do not see the authors of these outcries moved to pity for the poor on account of advances in the cost of flour and potatoes or in rent; the motif is milk. Now it happens that the poor are not large consumers of milk outside of the amount necessary for infant feeding, and that the small additional burden of perhaps a cent a day could go on for a long time before the whole would amount to the cost of the smallest casket or the services of the most considerate undertaker. But it is not consideration for the poor; it is an ingrained opposition to pay more for milk than was paid a quarter of a century ago. The general population regards the pure clean milk problem as a fad of theorists and of gentlemen farmers who keep cows instead of yachts. It does not know the importance of clean milk, and unfortunately is, in large part, able to point to the fact that for a month, or a year, or a boyhood it lived on a farm and milked a cow and knows all about it. The public needs proper education that clean milk is a necessity and that infant sickness and funerals can be reduced at least 40 per cent. at almost no cost in comparison. As to the middleman, it may be said that his share in promoting infantile mortality is as great as, but no greater than, that of the customer. He is to some extent a necessary evil, but he has been eliminated in some places and can be in others. Naturally, he wants as much profit as he can get; he would like to raise his price; he would like to pay the producer less. The producer must bear the burden of increased cost of grain and hay; it is for him to provide the ice, for him to provide the labor involved in maintaining general cleanliness and proper methods. Everything is put upon the producer, and unless his herd is large and his farm extensive and otherwise profitable, he cannot bear it and produce clean milk. Direct delivery to the properly enlightened customer would make the clean milk problem simple for the small producer; and so would co-operative handling, so much in vogue in the relatively most important dairying country in the world—Denmark, where the incorrigibly or deliberately dirty producer cannot dispose of his supply.

The general elimination of the middleman is, of course, not a possibility, especially in the case of large cities which are supplied from areas a hundred or hundreds of miles away. But associations satisfied with a reasonable profit, like the two large companies of Copenhagen, for example, can handle the matter with justice to all concerned. The customer must pay a fair price, the producer must receive one, and the distributing centre should make a reasonable return on its capital. If the milk of a farm where filth is the rule, where the cows are not free from garget and other diseases and are not regularly inspected by a competent veterinarian; where ice is not used in cooling; where dairying methods are faulty, and other objectionable conditions obtain; if the milk from such a place is declined, that of the clean dairy is not handicapped by an unfair competition.

It is said that model farms exist for the well-to-do, without whose patronage they would invariably fail; that they cannot be made to yield a profit in competition with ordinary farms. A model farm properly manned certainly cannot compete on equal terms with a filthy farm, where no attempt is made to conduct the business in a decent manner, especially if the customers are indifferent. The dirty producer can even afford to cut prices and take customers away from the other, if customers care to save a cent and make it up in pus and cow-dung. But one does not need to run a model farm in order to have clean milk. Concrete floors and walls and monitor-top barns are not absolutely essential, however satisfactory, in the production of clean milk. A clean man can keep a few healthy cows clean in a clean barn and use clean utensils and decent methods and make clean milk without increased cost, except in summer for ice; but with large herds the employment of others becomes necessary, and perhaps one or more men must give their whole time to keeping the cows, the premises, and the utensils clean. The dirty dairyman dispenses with these and thus has an unfair advantage in competition. If the product of dirty farms, large and small, were refused a market, model farms and small, clean, ordinary farms could thrive on equal terms. A large model dairy farm with an enlightened clientèle can be profitably operated even in competition with unclean farms; and this is done in many places. But they supply but small fractions of the populations in which they operate; and what is needed are clean farms everywhere, supplying profitably entire populations educated to refuse dirty milk at any price.

ORIGINAL ARTICLES.

A CLINICAL STUDY OF EIGHTY CASES OF EXOPHTHALMIC GOITRE.[1]

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Exophthalmic goitre is a more complex disease than was originally supposed and there are many yet unsolved problems in connection with its varied phenomena. The modern view that it is

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[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May 15 and 16, 1906.